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PREVENTION OF MALARIA.

The following summary regarding malaria and its prevention is taken from a report on malaria investigations in the island of Mauritius by Prof. Ronald Ross, of the University of Liverpool:

Facts regarding malarial fever.—In the light of modern knowledge it may be safely affirmed that malaria will not remain in a locality (1) unless the carrying agents (*Anophelines*) are numerous enough, (2) unless there is a sufficient number of infected persons to infect the carriers, and (3) if the insects are prevented from biting human beings.

Three groups of preventive measures may therefore be employed to reduce the disease, namely: (1) Anopheline reduction, (2) case reduction, (3) isolation.

The precise details of the first method were first laid down in 1899 and have since been put into practice with great success in both the Suez and Panama canal zones.

The second great antimalaria measure, that of case reduction, was originated in 1900 by Koch and Celli, who, feeling doubt as to the possibility of mosquito reduction, urged that the best way of dealing with malaria would be to leave the mosquitoes alone and to cure the human patients from whom the insects become infected. Thus, though mosquitoes would continue to abound, they would find no parasites to carry. By the use of this method Stephansort, in New Guinea, was cleared of malaria by Koch in a few months.

The third measure, isolation or protection from bites of mosquitoes, has been unconsciously in use for a long time, the ancient Romans being already familiar with mosquito nets, while in America wire gauze screens for windows and verandas have long been employed.

Relative value of these measures.—It is obvious that any of the above measures, if completely carried out, must result in the complete suppression of endemic malaria in any locality. On comparing them, however, the first consideration which must strike the practical sanitarian is the following: Isolation and case reduction require ready compliance on the part of the public; mosquito reduction does not. To use culicifuges and mosquito nets, to screen windows and verandas, to take quinine day after day, to force one's children to take it, and to submit to constant inspections require an endless amount of trouble on the part of the people, equal trouble on the

part of the authorities, expense, and perhaps friction with the community. On the other hand, no one objects to the drainage of swamps and clearing of water courses, which can be done by the authorities without troubling anyone.

Next, case reduction guards against malaria only, but isolation and mosquito reduction protect against all mosquito-borne diseases.

Again, isolation gives only partial and temporary respite from mosquitoes; mosquito reduction, where thoroughly carried out, a much greater security.

Lastly, mosquito reduction has a great general sanitary advantage which is not conferred by the other measures. It practically compels the sanitary department to maintain a minute inspection of the area in its charge and becomes therefore a sort of general insurance policy for good sanitation.

Theoretically, therefore, mosquito reduction has the advantage in every way. Practically, however, the preference for any of these measures must be determined by local conditions, as questions of cost and feasibility have to be considered. The following general law has been enunciated by Doctor Ross: The greater the density of population the greater the advantages of mosquito reduction. In rural areas mosquito reduction may not be nearly so advantageous. This measure is for the city, the town, and perhaps the village, not for the wilderness. For isolated houses, quinine, isolation, and treatment of small neighboring waters, if possible, are called for; larger works of drainage can be indulged in only by rich house owners, not by the authorities. Also in small towns and villages situated in the midst of large marshes or marshy forests, or flat, water-logged country, the cost of mosquito reduction may be too great.

General preventive measures.—The measures likely to do most good for the expenditure of money and labor involved are the following: (1) Measuring the amount of malaria in the locality affected. (2) Treatment of children in schools, and a certain amount of free distribution of quinine. (3) House protection. (4) Mosquito reduction where advisable (*a*) by minor works and (*b*) by major works. (5) A suitable permanent organization and an annual malaria report.

(1) The ideal way to ascertain the amount of malaria in a locality would be to search for the parasites in the blood of every person in the place. But the parasites can not often be found even when present; too much time is taken by such an examination, and hence to estimate correctly the proportion of infected people throughout a large population would be a great and practically impossible task. The blood examination should therefore be used only for small populations. For large ones there is, however, available a much easier though less rigid method, which consists in examining the people for enlargement of the spleen, so frequent in cases of malaria. This can be done literally in a few seconds for each person. In practice, also, the examinations are usually confined to children, say, under 16 years of age. This is done for several reasons. Children are easily accessible in schools, while men are generally out at work, and women often object to the examination. But the most important reason is that adults have in many cases become partially immune.

By taking a *periodical spleen census* of school children there can be determined: (1) The localities most affected by malaria; (2) the

effect of the preventive measures; (3) the children who require treatment. For this purpose a register of all children of 15 years or under with enlarged spleens should be kept at each school. This register should contain the age, sex, and names of the parents of the children, with columns for noting whether the enlargement is small, medium, or great, and a column for remarks. An examination of all the children attending school should be made every quarter by a medical officer, for the purpose of selecting those with enlarged spleen and making the proper entries in the register. Twice a year the figures and data in this register should be collected and forwarded to the health department.

(2) *Treatment of children and free distribution of quinine.*—The objects proposed are to improve the health of the individuals (especially children) and to prevent them from becoming a source of infection to others. Children are the principal homes of the parasites, and can be treated more methodically in schools than elsewhere. At each quarterly inspection the medical officer should indicate the children with enlarged spleen, who should be given quinine, and the dose for each. This would be regularly given to the children by the teacher until discontinued by order of the medical officer. The dosage and mode of administration of quinine should be left largely in the hands of each practitioner. It seems, however, preferable to use small and frequently repeated doses rather than occasional large ones.

(3) *House protection.*—This is suggested chiefly as a prospective vicarious measure, its object being to exclude mosquitoes in localities where, owing to large marshes or much forest, they can not easily be reduced. The aim to be attained would therefore be the design of a type of a house which will exclude mosquitoes, and could be adopted by the community, and failing in this a cheap method to protect the houses by wire or muslin netting could be devised.

(4) *Mosquito reduction.*—The measure is advised, as a rule, only for densely populated areas. The works required may be divided into two classes, minor and major works. Minor works are those which can be continuously carried out without the special services of an engineer, such as the clearing of water channels and drains, release of surface pools, filling of holes, removal of house breeding waters, cutting of underwood, removal of grass, weeds, etc., from the margin of ponds and streams, etc. Major works are those which require to be designed by an engineer, such as the drainage of swamps, canalization of streams, etc.

(5) *Annual report.*—Here should be given the details of the work done during the year with the cost and the results obtained, and also figures for previous years for comparison.